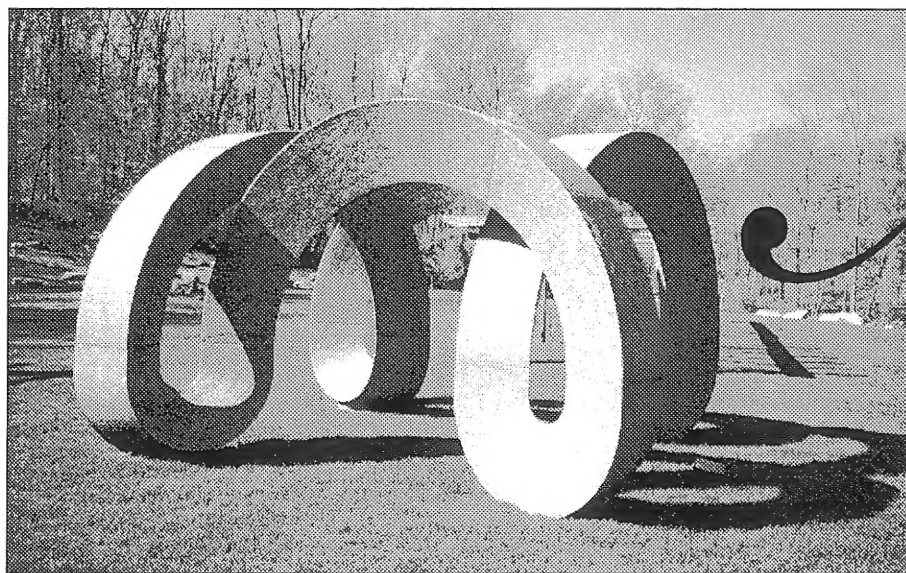
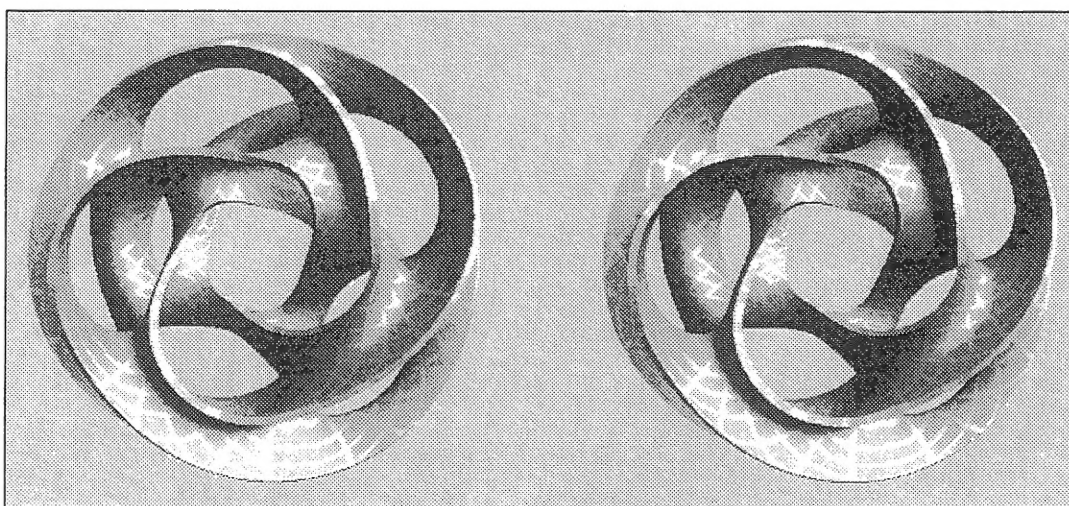


Vol. 17/No. 12

Nov./Dec. 1997



*The Arch of Janus*, by Charles Perry. Granite, 14'x14'x10', private collection.



Cross-eye stereo display of a ring with five monkey saddles and 180° of twist.  
By Carlo Séquin.



*Attitudes*, by Arthur Silverman. Aluminum, Elysian Fields Sculpture Park, New Orleans, LA.

Art

&

Mathematics

# Reunification and Hyperseeing

From the Editor

**Nat Friedman**

Professor of Mathematics  
SUNY-Albany

*One can see certain  
mathematical forms as  
art forms, and creativity  
is all about seeing from a  
new viewpoint*

**I**N A SEASHELL WE SEE THE ONENESS OF ART, mathematics, and architecture. A seashell is an abode that is also an ingenious spiral form-space sculpture. Seashells also display a variety of beautiful two-dimensional designs on curved surfaces. Thus the oneness of art, mathematics, and architecture was already genetically coded in these very early life forms. I can imagine what it was like to have experienced the excitement of living in Florence during the Renaissance when there was no separation between art, mathematics, and

architecture. This unification also resulted in a mutual enrichment of these fields. It is my purpose to energize a move toward a reunification of these fields in education.

For the record, I have been a professor of mathematics at the State University of New York at Albany (SUNYA) since 1968. In 1971 I took a sculpture course at SUNYA and have been avidly carving wood and stone ever since. In 1980 I introduced an interdisciplinary course: "Art, Mathematics, and The Creative Process." Art and mathematics are both involved with seeing relationships. One can also see certain mathematical forms as art forms, and creativity is about seeing from a new viewpoint. Thus it's all about seeing. As the Spanish sculptor Eduardo Chillida states "to look is one thing, to see is another thing," "to see is very difficult, normally," "to look is to try to see," "I have looked and I hope I have seen" (item [C] in references at end of article). An excellent related article is Levine's *See-Duction* [L]. In education we have the Three R's and now it's time to add the S (for seeing).

In 1992 I organized the first art and mathematics conference (AM92) at SUNYA. This has been followed by AM93, 4, 5, 6 and 7. The AM conferences have been a wonderful experience. As Steve Whealton said at AM97, "I found my tribe." For me, the gift from the AM tribe has been learning to see in exciting new ways.

In particular, the sculpture *Attitudes* by Arthur Silverman (shown on the cover) led

me to a deeper understanding of the concept I refer to as hyperseeing. First, note that in order to see a two-dimensional painting on a wall, we step back in the third dimension. We then see the shape of the painting (generally rectangular) as well as every point in the painting. Thus we see the painting completely from one viewpoint. Now theoretically, to see a three-dimensional object completely from one viewpoint, we would need to step back in a fourth dimension. From one viewpoint, we could then (theoretically) see every point on the object, as well as see every point within the object. This type of all-around seeing, as well as a type of x-ray seeing, was known to the cubists such as Picasso and Duchamp and is discussed in [H]. In particular, cubists were led to showing multiple views of an object in the same painting.

In mathematics four-dimensional space is referred to as **hyperspace** and I refer to (theoretical) seeing in hyperspace as **hyperseeing**. Thus in hyperspace one could hypersee a three-dimensional object completely from one viewpoint.

Although we do not live in hyperspace, it is still desirable to attain a type of hyperseeing. This is possible when viewing *Attitudes*. Silverman placed six copies of the same object on separate bases in six different orientations. The object consists of a rectangle, parallelogram, and two triangles. People viewing the six separate sculptures often do not even realize that it is the same object. I refer to the set of six sculptures in *Attitudes* as a hypersculpture.

In general, a **sculpture** is defined as an object in a given orientation relative to a fixed horizontal plane (the base). Two sculptures are said to be related if they consist of the same object in different orientations. Note that it may not be obvious that two sculptures are related. A **hypersculpture** is a set of related sculptures. As in the hypersculpture *Attitudes*, there are abstract three-dimensional objects that have several interesting orientations. To more completely appreciate the diverse sculptural content of the object, it is natural to present it as a hypersculpture. Furthermore, the experience of viewing a hypersculpture allows one to see multiple

**Art & Math: Page 3**

## Dimension Dementia

**Tuesday**, November 11, 7:30 PM  
McBean Theater, The Exploratorium  
3601 Lyon St., San Francisco  
(Note: It is on Tuesday this month!  
Contact: Trudy, (650) 856-9593.)

Visual artists are intrigued by the geometry of space for a good reason: It underlies the very fabric of how everything goes together. How do mathematicians explore this?

**Robert Osserman** plans to explore beautiful minimal surfaces with us. He is Professor Emeritus of Mathematics at Stanford University. He was a speaker and organizer of the Fermat Fest that sold out the Palace of Fine Arts Theater in 1993, and in 1995 his book, *Poetry of the Universe: A Mathematical Exploration of the Cosmos* was chosen by the Boston Globe as one of the top ten nonfiction books of the year. He has had a lifelong interest in conveying the beauty and power of mathematics to non-mathematical audiences.

**Wally Downs** presents *Uses of Geometric Solids in Art, Nature, Industry, and Architecture*. There will be slides and geometric models. He is owner of Pacific Radomes, Inc. located in Santa Clara. His company builds radomes and microwave reflectors for the military and aerospace industry. He is author of two books, *Practical Conic Sections* and *Practical Geometric Solids*.

**Nick Jackiw**, designer of the *The Geometer's Sketchpad* educational software published by Key Curriculum Press, presents *Using Geometer's Sketchpad to explore computer graphics with high school kids*. Plan to stay and play with this wonderful exploratory tool!

## Organizing an Ylem Exhibition

If you organize a show with several Ylem artists where the art is related to either technology or science, and is presented and promoted in a professional manner, then Ylem can help you by sending you information about Ylem to go in your publicity packets. If you are in the San Francisco Bay Area, Ylem can share:

- an up-to-date list of galleries
- an up-to-date media list
- printers who do postcard invitations at a good price.

Contact:

Trudy Myrrh Reagan  
967 Moreno  
Palo Alto, CA 94303 USA  
(415) 856-9593  
<trudymyrrh@aol.com>

**Helen Golden**, **Bonny Lhotka**, **Judith Moncrieff**, **Karin Schminke** and **Dorothy Simpson Krause** were artists-in-residence at the "Digital Atelier" at the National Museum of American Art at the Smithsonian in July. It was the first time an experimental digital printmaking studio was housed in a major art museum... Among the presenters at ISEA 97 in Chicago in September were **Hans Delhinger**, **Ken Goldberg**, **Craig Harris**, **Eduardo Kac**, **Roger Malina**, **Ron Pellegrino** and **Stephen Wilson**. And those showing work included **Yoshiuki Abe**, **Phillippe Boissonnet**, **Lucia Grossberger-Morales**, **Eduardo Kac**, **Ken Rinaldo**, **Mary Stieglitz**, **Joan Truckenbrod**, **Roman Verostko** and **Anna Ursyn**... **Craig Harris**, editor of *Leonardo Electronic Forum* (LEA), is interested in hearing from people who can provide perspectives on ISEA for LEA this year, even from those who reached it from cyberspace. Contact him at <lea@mitpress.mit.edu>...

**Trudy Myrrh Reagan** of Ylem and **Nancy Tector** of Womens Caucus for Art, South Bay Chapter, were invited to curate the show, "Finding the Fulcrum," in honor of the thirtieth anniversary of *Leonardo*, the journal for the International Society for the Arts Sciences and Technology (ISAST). Exhibitors included **Ruth Eckland**, **Helen Golden**, **Nancy Gorglione**, **Therese Lahaie**, **Michael McGuire**, **Alex** and **Martha Nicoloff**, **Sonya Rapoport**, **Edith Smith** and **Nancy Worthington**. It was held at 111 Minna Street Gallery in San Francisco in October...

Technology journalist **Linda Jacobsen** spoke at a forum, "A Cyberfeminine Perspective," part of the NTT New Media Minds Fall Lecture Series in San Francisco... Digicolor Fine Art Editions in Seattle just inaugurated its new Fine Art Digital Printmaking Department with an open house and exhibit of IRIS prints, according to Art Director **Stephen Rock**... **Mary Stieglitz** has been appointed as Professor and Departmental Executive Officer of the Department of Art and Design at Iowa State University, Ames, Iowa. The department has over 60 faculty... Former member **Les Barta** had a solo show of his computer photoconstructions at Arkansas State University... **Jo Falcon** was one of the collaborators on the Exploratorium Web site at <<http://www.exploratorium.edu/snacks/index.html>> which was awarded a "Blue Web'n"—an honor reserved for the best online lessons, activities, projects, resources, references, and tools...

At "ChikTek: Women Artists Defining Technology" Symposium and art exhibit, **Diane Fenster** and **Tamiko Thiel** were among the presenters. Thiel talked about the Starbright World VR playspace and also showed her Totem of Heavenly Wisdom installation: <[http://cadre.sjsu.edu/chik\\_tek/](http://cadre.sjsu.edu/chik_tek/)>... On Labor Day, **Jim Thompson** was at Burning Man in the Nevada desert, and writes: "I got 4 of my 8 'O-mega' project balloons up with the lights in them. It looked super awesome but a big wind came up and wrecked them all! The course of true art never did run smooth!"



# Art & Math: New ways to see

From page 1

views from one viewpoint which therefore helps to develop a type of hyperseeing in our three-dimensional world. A more complete discussion is given in [F]. Also see [B], [R1] and [R2].

One can also consider "hyperseeing" a single sculpture in our three-dimensional world as described by the world-renowned sculptor Henry Moore [J]:

*This is what the sculptor must do. He must strive continually to think of, and use, form in its full spatial completeness. He gets the solid shape, as it were, inside his head—he thinks of it, whatever its size, as if he were holding it completely enclosed in the hollow of his hand. He mentally visualizes a complex form from all round itself; he knows while he looks at one side what the other side is like; he identifies himself with its center of gravity, its mass, its weight, he realizes its volume, as the space that the shape displaces in the air.*

Moore also carved spaces through the form:

3 *The liking for holes came about from wanting to make space and three-dimensional form. For me the hole is not just a round hole. It is the penetration through from the front of the block to the back. The space connects one side to the other, making it immediately more three-dimensional. A space can itself have as much shape-meaning as a solid mass. Sculpture in space is possible, where the stone contains only the space, which is the intended and considered form.*

From the above quotes we gain a feeling for how Moore saw a sculpture as a composition of shape in both form and space. He saw from all around the sculpture as well as into and through the sculpture. This was Moore's hyperseeing and serves as a definition of hyperseeing in our three-dimensional world.

The mathematical theory of knots is an important branch of topology. Knots also suggests shapes for

wonderful form-space sculptures. They are totally three-dimensional with no preferred top, bottom, front, or back and can look quite different when viewed from different directions. They are also open forms that one can see through, so they are ideal examples of sculptures on which to practice hyperseeing. Two sculptures based on forms of the trefoil knot are shown in Figure 1. They are made of folded tinfoil and used for classroom exercises.

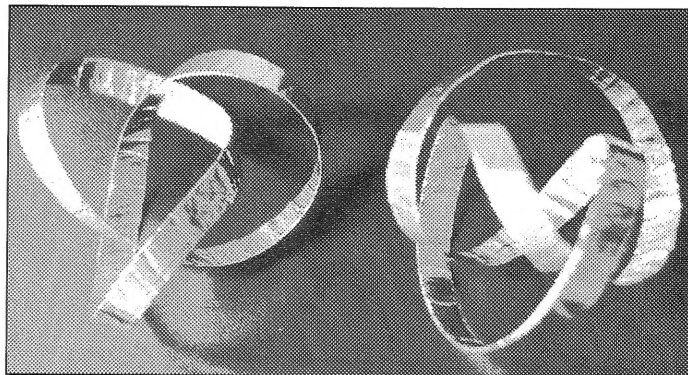


Figure 1.

The examples in the following papers illustrate the richness of art inspired by mathematics. The collaboration of Brent Collins and Carlo Séquin is one of the really exciting developments in the AM world. Beth Whiteley combines geometry with a very highly developed sense of color. Arthur Silverman's passionate interest in the tetrahedron consistently yields sculptures of formal elegance. Charles Perry's sculpture inspired by mathematics and architecture is unsurpassed.

Nathaniel Friedman (Albany, New York) is a sculptor, print maker, and professor of mathematics at SUNY-Albany. He has organized the art and mathematics conferences AM92-97. In addition to being a carver, he has developed an original technique for making natural fractal stone prints.

**For information on the 1998 Art and Mathematics Conference (AM98) please see the calendar.**

[B] Thomas Banchoff, *Beyond the Third Dimension: Geometry, Computer Graphics, and Higher Dimensions*, Scientific American Library, New York, 1990.

[C] Eduardo Chillida, Basque Sculptor, Video, *Home Vision*, 24, 1985.

[F] Nat Friedman, *Hyperspace, Hyperseeing, and Hypersculpture*, preprint.

[H] Linda Dalrymple Henderson, *The Fourth Dimension and Non-Euclidean Geometry in Modern Art*, Princeton University Press, 1983.

[J] Phillip James, *Henry Moore on Sculpture*, Macdonald, 1966.

[L] Howard Levine, *See-Duction: How Scientists are Creating a Third Way of Knowing*, Humanistic Mathematics Network Journal #15, 1997.

[R1] Tony Robbin, *Fourfield: Computers, Art, and The Fourth Dimension*, Bulfinch Press, Boston, 1990.

[R2] Rudy Rucker, *Geometry, Relativity, and The Fourth Dimension*, Dover, New York, 1977.



# Symmetry, Series and Systems

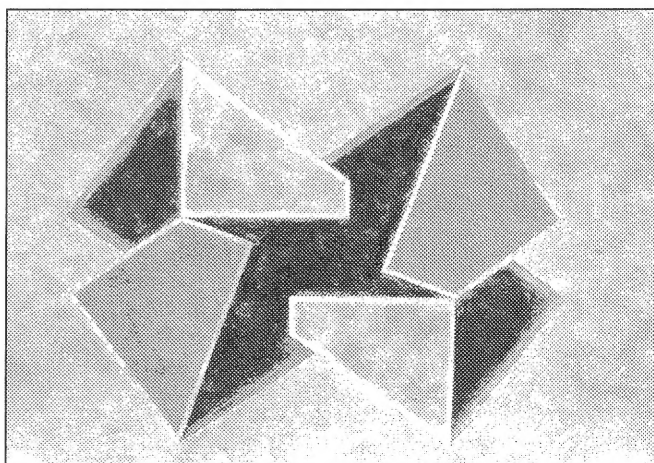
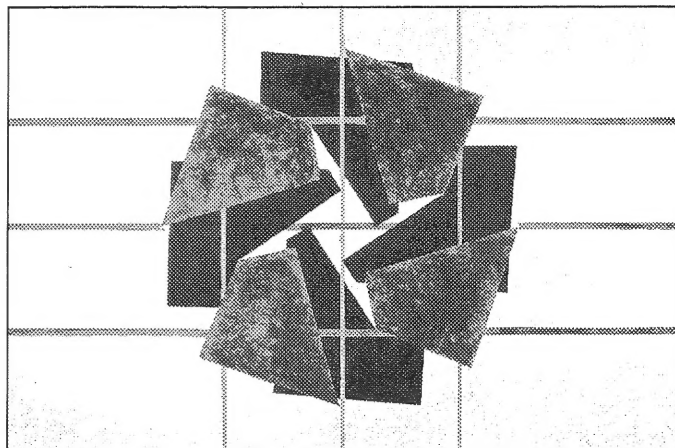
by Elizabeth Whiteley

I am attracted to dynamic symmetry. It is the ordering element for my artistic and scientific explorations of the space of rectangles which have the ratios of  $\sqrt{2}$ ,  $\sqrt{3}$ , and  $\sqrt{5}$ .

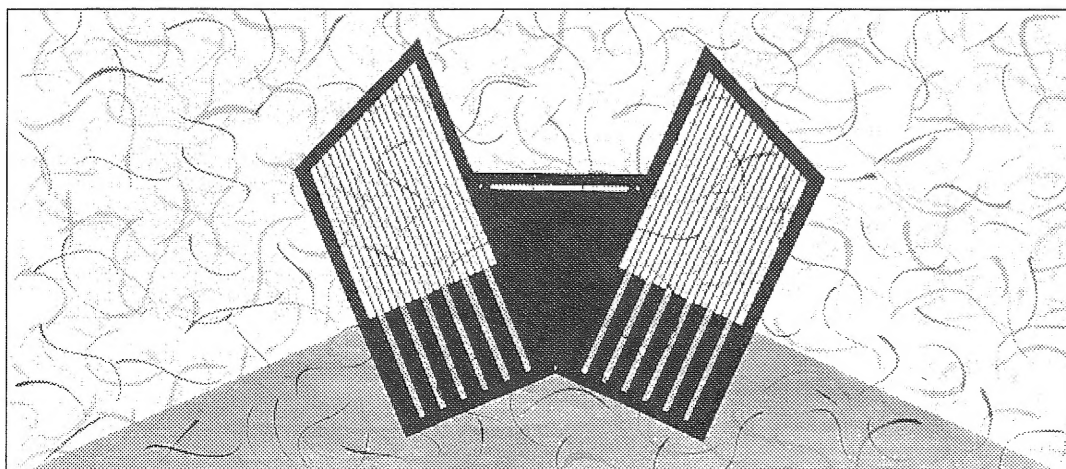
I'm fascinated by geometric images in a series. The first image points the way to the second image, the second image points the way to the third image, and so forth. The visual evolution has pace and pattern. The series intrigues the eye. It depends upon the changing arrangement of lines which enclose fields of space. I decompose the two-dimensional spaces with lines, fold the spaces in the third dimension, and select configurations of planes to use as models for intensely colored paintings on canvas and paper.

I'm curious about systems of shaped planes. My hierarchy has four generations of images. They are selected intuitively from a large set of images developed by a rational procedure. At the first level, the harmonic Decompositions express the energy of the space. Then, the Shapes describe the spatial transformation of a folded three dimensional form to a second dimension image. Next, the Icons are created by simplifying complex line drawings of the Shapes. Finally, the Super Icons represent the most elaborate invention. They are produced by simplifying complex line drawings of the Icons. For visual and scientific consistency, each Decomposition, Shape, Icon, and Super Icon is painted in a rectangular space which has the ratio of the original  $\sqrt{2}$ ,  $\sqrt{3}$ , or  $\sqrt{5}$  rectangle from which the image is derived.

Elizabeth Whiteley (Washington, D.C.) is a painter and printmaker who combines geometric forms with beautiful color. She was a speaker at AM95 and AM96. Her work is based on dimensions related to 2, 3, and 5.



4



Top: Root-Two Super Icon II, Elizabeth Whiteley, Acrylic on canvas, 48" x 34"

Above: Root-Two Icon I, Elizabeth Whiteley, Acrylic on canvas, 48" x 34"

Left: Root-Five Study I, Elizabeth Whiteley, Acrylic and ink on paper, 18" x 8"

# Morphology to Sculpture

by Charles O. Perry

Morphology is a fascinating science. This is the mathematics of all our material world, the architecture and sculpture of nature (and us). My work has always started from this direction.

Three of the recent pieces that I have been working on intertwine mathematics, sculpture and architecture. This was an unconscious effort; for me it's just the way the sculpture "wants to be." The perceptible order of my work is always trying to reach back into our brain and whisper "what does it mean?"

The earlier granite piece is called *The Arch of Janus* (see cover) after the four way Arch of Janus in Ancient Rome. It started as one of those models lying around the studio, left over from some previous study. It was waiting in the wings, so to speak.

The inspiration came from the client who asked if this dusty model could be made in granite. I immediately answered yes and then proceeded to see if it was possible.

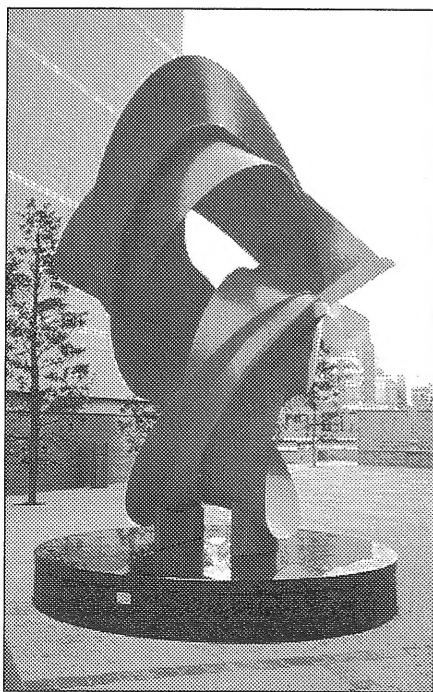
What you see stretches the limits of granite while it sits squarely on the border of sculpture and architecture. Moreover, it asks you to interact with it. I think of it as both symbolic and playful.

This piece happens to be a torus Möbius while the second of the three is not. Its real relation to morphology seems stretched yet it follows its own set of natural laws.

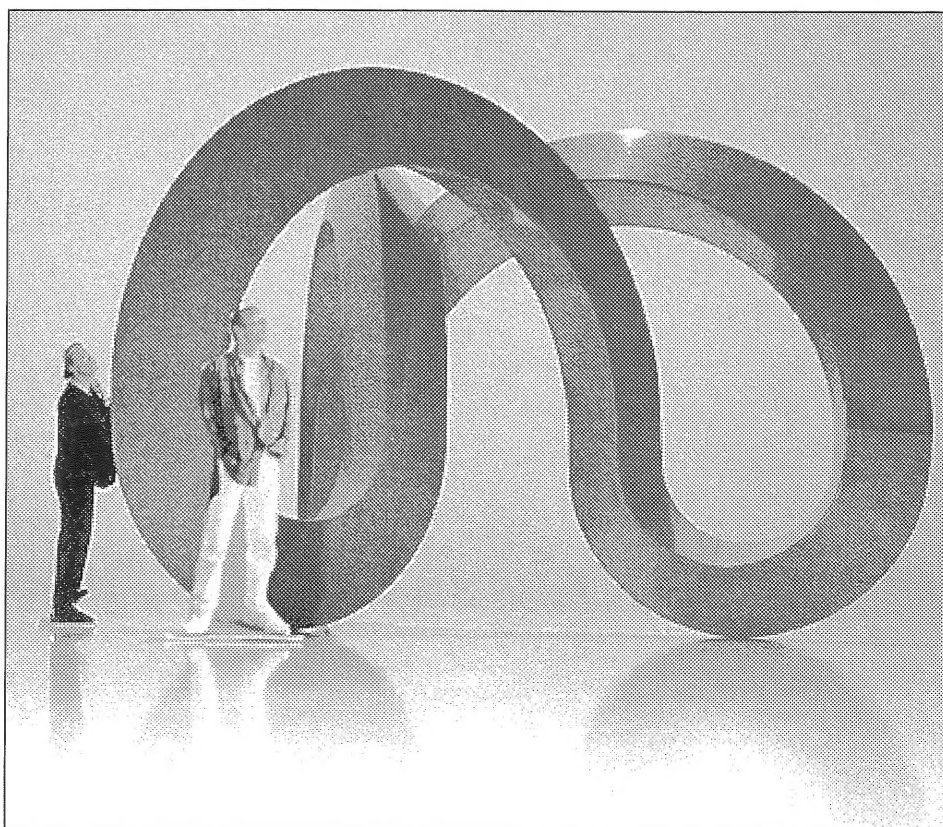
The red piece (shown as a model below) as yet unnamed, is designed for a new college near Tokyo, Japan. Granite was not practical in that seismic environment. The form I desired was something to remember, something friendly to gather by, the vortex of the campus plaza. It was important in this case to make the symmetry less obvious. While the granite piece provides a passage through, this piece is more a focal point for the college.

The third work, shown below left, was for the Kinshi Cho Rail Station in Tokyo. It is clearly sculpture, hardly architectural and hides a lot of mathematics. It is called reverently *Rondo* after Mozart's Rondo in D major, (KV382) because it is a Möbius which is wound through itself three times.

Charles Perry (Norwalk, Connecticut) has an international reputation as a sculptor and designer. He was a speaker at AM92 and AM95. He is a world leader in the field of sculpture influenced by mathematics.



Above: *Rondo*, Charles Perry. Aluminum, 16' x 8' x 6'. Tokyo.



Right: *Untitled*, Charles Perry. Model for Tokyo.

# Ylem Calendar

Some calendar items are reprinted from *Art Calendar* (the monthly marketing and career management journal for artists, PO Box 199, Upper Fairmount, MD 21867. Subscriptions, \$32 p. year), *Wired*, *Multimedia Reporter* (from North Bay Multimedia Assn.), *Artweek*, *Leonardo Electronic Almanac*, *Artswire* (<[www.artswire.org](http://www.artswire.org)>), *ArtTech* (<[artstech@thecity.sfsu.edu](mailto:artstech@thecity.sfsu.edu)>) and *FineArts Forum Online* (<[paul\\_brown@siggraph.org](mailto:paul_brown@siggraph.org)>). We cannot verify all information sent to us. Readers, inform us of incorrect information, please.

All events and exhibits are in the San Francisco Bay Area except where noted.

We want your announcements! To assure they appear in the next newsletter, send 6 weeks before publication date. **Also** send notices to the Ylem website where they can appear on shorter notice. (Addresses on back cover.)

Ylem Forums are held the second Wednesday of January, March, May, July, September and November (odd-numbered months) at the Exploratorium, 7:30 pm.

## Events

Through November 26

### Life Clusters

An exhibit that includes Ylem members **Barbara Plowman, Kit Monroe Pravda, Sonya Rapoport** and **Nancy Tector** examines the role of art groups in furthering the growth of the individual artist.

*Call for hours. Euphrat Museum of Art, De Anza College, 21250 Stevens Creek Rd., Cupertino, CA; (408) 864-8836*

Through November 30

### Fields and Figures

An exploration of bytes, body and mind by Ylem member **Jonathan C. Wessel**.

*Thur-Sun 1-5 pm. 1870 Art Center, 1870 Ralston Ave., Belmont, CA; (650) 595-9679*

November 5, 7 pm

### Art, Technology & Culture

This is a new colloquium at UC Berkeley held Wednesdays throughout the 1997-98 academic year. Bruce Tomb and John Randolph, IOOA, will be guest speakers. See listings below for other speakers.

*160 Kroeber Hall, UC Berkeley*

November 12, 7:30 pm

### Lectures On Contemporary Art

Presentation by photographer and video artist Susan Derges, whose work draws upon the physical sciences and an interest in light, vibration and harmony.

*Mills College, Lucie Stern Building, 5000 MacArthur Blvd., Room 100, Oakland, CA; 510-430-2117*

November 19, 7 pm

### Collaboration Of Artists & Engineers: Past, Present & Future

Billy Kluver, EAT, New York City, will speak as part of the Art, Technology & Culture colloquium.

*160 Kroeber Hall, UC Berkeley*

December 8, 7 pm

### The Computer As Illusion Machine

Lev Manovich, UCSD Art and Art Practice, will lecture as part of the Art, Technology & Culture colloquium.

*160 Kroeber Hall, UC Berkeley*

November 10, 7:30 pm

### Ylem Forum: Art and Math

Details on page 2.

*Please Note: Forum is on Tuesday night, due to a conflict in the Exploratorium's schedule.*

## Exhibits

November 6–December 9

### Of Two Minds

A 30-year retrospective by **Trudy "Myrrh" Reagan**, founder of Ylem. One aspect of this show treats social issues and historical events, celebrating the 25th anniversary of Watergate with her Watergate portraits. Another aspect is images relating art, science and spirit.

There will be a reception November 7, 5:30-8:30 pm. The exhibit will be weekdays and after church.

*First Unitarian Church, 1187 Franklin, San Francisco; 415-776-4580*

November 14–March 14, 9 am–5 pm

### Artists' Uninhibited View Of Space Science

Exhibit by Colette Gaiter and Ylem members **Leah Lubin, Mike Mosher** and **Myrrh**. Mosher and Gaiter present interactive works on the computer, investigating how space science fits into total society. Lubin and Myrrh are painters, dealing with subjects cosmic and human, those of unseen energy and our location in time and space.

There will be a reception Friday, November 14, 5:30-7:30 pm. The exhibit will be on weekdays.

*NASA Visitor Center, NASA-Ames Research, Mountain View*

### Ads From Hell: Show By Rozdimon (New York, NY)

This is the story about Ajax, Clorox2, Coca Cola and other wonderful products that have had a profound effect on the artist.

*vOID, 16 Mercer St., New York, NY; <<http://www.users.interport.net/~rozdimon>>*



## Memetic Mutation

This interactive installation explores a language-based artificial life model which evolves and mutates during the period of the exhibition.

To monitor online, check out: <<http://www.monash.edu.au/mongall/memetic/>>; <noodle-boy@peg.apc.org>

## Silicon Valley Institute Of Art & Technology

Silicon Valley Institute of Art & Technology provides a high-visibility venue for the presentation of exhibitions and performances oriented to high-tech art utilizing computer technologies, electronics and optics. Prominent local and national artists are represented by a wide variety

of works that explore the frontier of the new media and technology.

Art-Tech promotes further development and refinement of digital technology in art as well as experimentation with methods of presentation. The gallery is currently looking for artists using emerging technologies in their work, such a digital photography, electronic art, interactive installations, robotics.

89 S. 1st St., San Jose, CA 95113; 408-971-9100; fax 408-971-9191; <SVIArttec@aol.com>

## Opportunities

### Deadline November 1 TV & Broadcasting On The Internet (Bradford, UK)

The British Computer Society of Computer Graphics, Displays Group is

calling for submissions on the theme of television and broadcasting on the Internet, WWW and networks, for their 1998 conference, April 21-23. A book based on, but not restricted to, papers presented at the event will be published after the meeting.

For submissions, contact: Prof. R.A. Earnshaw, *Electronic Imaging & Media Communications, University of Bradford, Bradford BD7 1DP UK*; tel +44-(0)-1274-384001; fax +44-(0)-1274-383727; <R.A.Earnshaw@bradford.ac.uk>

For info: Huw Jones: <d.h.jones@mdx.ac.uk>; Roy Middleton: <R.Middleton@ed.ac.uk>; Prof. John A. Vince: <qj95@dial.pipex.com>

Deadline November 21

### Consciousness Reframed (Newport, Wales, UK)

The 2nd International CAiiA Conference (August 19-23, 1998) is a forum for the presentation and discussion of issues and developments in the interrelationship of art, technology and consciousness. Papers and panels are invited from researchers in all disciplines involved in exploring this subject.

For more info, contact: <aces@newport.ac.uk>; CAiiA—Centre for Advanced Inquiry in the Interactive Arts, University of Wales College, Newport, Caerleon Campus, PO Box 179, Newport, NP6 1YG, Wales, UK; <<http://caiiamind.nsad.newport.ac.uk>>

### Deadline February 28 1st International Conference On Virtual Worlds, July 1-3, 1998 (Paris, France)

The International Institute of Multimedia, Paris, France, hopes to extend the scientific community by encouraging contributions from people involved in technical, philosophical and artistic work related to the design and application of virtual worlds. This interdisciplinary conference aims to provoke new understandings of the important role that such virtual worlds will play in business, computer games, and education. It will investigate the relationship between the natural and the artificial in terms of both theory and practical application.

Contact: Jean-Claude Heudin, *Institute International Multimedia, Pole Universitaire Leonardo de Vinci, 92916 La Defence CEDEX, France*; tel (33) 01 41 16 75 70; fax (33) 01 41 16 75 75; <Jean-Claude.Heudin@devinci.fr>

Deadline February 28

### VW98: Artificial & Virtual Worlds (Paris, France)

Call for papers and participation. Important dates: notification of acceptance: April 1998; camera-ready due: May 1998; conference: July 1-3, 1998.

Contact: Jean-Claude Heudin, *Conference Chair*: <Jean-Claude.Heudin@devinci.fr>; *Silvie Perret, Conference Secretary*: <Silvie.Perret@devinci.fr>

### International Macromedia Contest

Macromedia is interested in innovative content developed with any Macromedia tools, such as FreeHand, Director, Authorware, Flash, Extreme 3D, SoundEdit

16. Selected work will be featured in the International section of the Macromedia Web Site, and participants will receive Macromedia polo shirts. All entries must come from outside the US, and must involve the use of one or more Macromedia tools.

Contact: <international@macromedia.com>

## Leonard Electronic Almanac

Leonard Electronic Almanac is redesigning the LEA gallery, and is interested in receiving proposals for new media works that explore the boundaries of art, science and technology. Send a project description, c.v.'s of the main developers, and examples of past works (Web and non-Web). If the proposal is for a non-Internet project, contact curator Patrick Maun for mailing address and submit material via snail mail.

Patrick Maun, <butoh@well.com>; <Patrick.Maun@fallon.com>; <<http://mitpress.mit.edu/LEA>>

## No-Budget Films (Chicago, IL)

MWMWM\*Chicago Project Room is asking for no-budget films from like-minded galleries. The concept of film is open and projects can be set up in endless ways (e.g., storyboards with sketches or still photos, scripts, video, super8).

Members/artists of these galleries are driven to explore the meaning of work/labor. This pursuit is at odds with the culture at large. Being a corporate

wage-slave might be difficult, being a 70's retro-abstract painter might be chancy, but being a service economy artist is hopeless. These film projects are messages-in-bottles, tossed into a Big Budget sea.

MWMWM\*Chicago Project Room, 2136 W. Chicago Ave., Chicago, IL 60622; 773-227-5873

### Needs & Offerings

June 1-4

### Mathematics and Design 98 (San Sebastian, Spain)

The 2nd International Conference on Mathematics & Design 98 is looking for participants: mathematicians, engineers, architects, designers and scientists interested in the interaction between mathematics and design.

Contact: <<http://www.sc.ehu.es/md98>>

### Academic Press Image Directory

This directory aims to become a key reference source similar to *Books in Print*. Users will be able to search the holdings of museums to locate images with the aid of the *Art and Architecture Thesaurus* and the *Union List of Artists' Names*. Records will contain information about rights and reproduction restrictions. Through secure transition software, users may order copies of images directly from the image owner through the database software. The Image Directory asks for no rights to either data or images and uses only low-resolution images.

August 3-7, 1998

## Art & Mathematics Conference (AM98)

The 1998 Art and Mathematics Conference (AM98) will be at the University of California at Berkeley, August 3-7, 1998. Speakers so far include Bruce Beasley, Fletcher Benton, Harriet Brisson, Brent Collins, John Conway, Helaman Ferguson, David Hoffman, Charles Perry, Arthur Silverman, and William Thurston.

For more information, contact Nat Friedman, Dept. of Math, University at Albany-SUNY, Albany, NY 12222; (518) 442-4621, fax: (518) 442-4731, <[artmath@math.albany.edu](mailto:artmath@math.albany.edu)> or Carlo Séquin, EECS, CS Div., Univ. of California, Soda Hall, Berkeley, CA 94720-1776; (510) 642-5103, fax: (510) 642-5775; <[sequin@cs.berkeley.edu](mailto:sequin@cs.berkeley.edu)>

...or visit <<http://http.cs.berkeley.edu/~sequin/AM98/index.html>>

More info can be found at:  
<<http://www.imagedir.com>>

### Arts Locator: Largest Gateway To The Arts On The WWW (Columbus, OH)

World Wide Arts Resources introduces its new ARTS LOCATOR, which allows visitors to check out arts-related sites in over 1000 cities worldwide. Arts enthusiasts and educators are invited to register their WWW art-sites with WWAR so they can be easily found by interested browsers.

For info, contact: Markus Kruse, World Wide Arts Resources, PO Box 10138, Columbus, OH 43201; <<http://wwar.com>>

### International Registry Of Artists & Artwork

The Getty Collection and Art Calendar are establishing a registry system for artists and artwork that will parallel the publishing industry's ISBN cataloging system.

For more info, contact:  
<<http://iraa.artcalendar.com>>;  
<[iraa@artcalendar.com](mailto:iraa@artcalendar.com)>

### MAP

In association with their project MAP (Moscow-Aix-Pereslavl: exchanges between French and Russian artists and scientists) CYPRES is starting a permanent workshop for art on the Internet. More than a simple tool for showing artwork, it is an attempt to achieve an interactive creation process among participants. CYPRES is calling for the participation of artists whose work fully exploits the possibilities and constraints of the Internet.

CYPRES, Villa de l'Ecole d'Art, rue Emile Tavan, 13100 Aix-en-Provence, France; <<http://www.aix.ensam.fr/cypres/>>; <[cypres@aix.ensam.fr](mailto:cypres@aix.ensam.fr)>; tel +33(0) 442 275 7351 fax +33 (0) 442 276 399. Université de Pereslavl: <<http://dll.botik.ru>> www Moscow Art

Center: <<http://sunsite.cs.msu.su/wwwart>>

### Out Of The Cave Into The Web: Artists On The Internet

Art Garret is a Web-based resource for student artists and art educators. The headline topic is discussed in its library section: how emerging digital and network tools will affect future art practice and education.

See: <<http://www.art.uiuc.edu/garret>>

### Website Services

Forum and Exhibition Show Reviews open to all artists for information exchange about arts issues, exhibits, etc.

Contact: Ann Contois or Steve Reynolds, Juried Online Arts Festival, 1501 Trace Creek Rd., Hamlin, WV 25523; 304-824-5651; <<http://www.jolaf.com/resources/reviews/>>; <<http://jolaf.com/resources/forum/>>



# The Ylem Annual Directory

The "Artists Using Science and Technology Directory" is a handsomely produced publication describing nearly 250 artists' fascinating specialties. It is abundantly illustrated. Collectors, curators, art critics, educators and libraries all use it as a resource. Production is paid for with picture fees. One year membership fee includes a copy of the edition of the Directory in which you are listed.

For the first time, Ylem will publish an online version on the Internet. Please read directions carefully.

*To be listed in the printed and/or online Directory, you must be a member of Ylem or join or renew by October 31.*

## PRINTED VERSION INSTRUCTIONS

You may submit either a printed PHOTO or a DIGITAL FILE.

**DIGITAL FILE:** TIFF or PICT format on 3.5" disk.

**PHOTO:** Securely attach the following information to the back of your original, and read the fine print below:

- Your name
- Caption for picture as it will appear: (Title, medium, date, dimensions, description if any)
- Arrow indicating top of image.
- Picture Fee:
  - \$25 for 1/4 page
  - \$50 for 1/2 page
  - \$90 for full page*Picture fees are in addition to membership dues.*
- Membership fee (if appropriate)
- Enclosed S.A.S.E. (if return of image desired)
- Completed form (see next column)

## ONLINE VERSION INSTRUCTIONS

Submit your color image in GIF or JPEG format on 3.5" disk. Include caption, etc., in text-only or ASCII format. And see checklist above!

- Listing in ONLINE VERSION: Send \$25
- Listing in BOTH versions: Send \$15 EXTRA.

### THE FINE PRINT—FOR PHOTOS

1. The printed Directory is a black and white publication. Images with good contrast and sharp focus are necessary. Please do not send color pictures or ones that have been screened.
2. We will do our best to scale the pictures to the area purchased, but due to the dimensions of the page, it may have to be scaled smaller if the picture is too narrow, vertically or horizontally.
3. If the art does not fill the picture area, we reserve the right to crop it.

## Ylem Directory Form

To be pictured in the Directory, please fill out this form and send with your submission materials by **October 31st, 1997.**

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- ☐ U.S. Institution \$45
- ☐ U.S. Student/Senior \$20
- ☐ Electronic Newsletter \$20
- ☐ Canada or Mexico \$5  
PLUS U.S. rate above
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### PRIVACY NOTICES

☐ Please do not list me AT ALL on the Internet in the online version of the Directory. [Note: if this box is checked, GIF or JPEG files will be returned].

☐ Please do not include my name when the Ylem mailing list is sold to other members for mailing.

**Mail to:** Ylem, P.O. Box 749, Orinda, CA 94563 USA



# Tetrahedral Variations

by Arthur Silverman

My sculpture is inspired, but not constrained, by mathematics (geometry). For about 20 years I've been investigating tetrahedral ideas for sculpture. My primary interest is in large scale outdoor work. I like the idea that the public and the site are very important considerations. All the pieces are fabricated by welding metal plates of the usual metals. The scale of my sculpture is from 60' to pedestal size.

I find that the unique geometric relations intrinsic to the tetrahedron persist in the final sculpture, notwithstanding all the manipulations I carry out. The main factor, as I understand it, is that these four-sided, three-dimensional forms can be resolved without consideration of the rectilinear three axes of the square grid. Perhaps a corollary to this feature is

that there are two characteristic qualities evident in most pieces: it's difficult to anticipate a view other than the present point of view, and the views may change abruptly as one walks around the work.

The accompanying photographs show two different works. The wall piece theme is derived from a cross-section of a tetrahedron. The large piece is made from stacking tetrahedra. It isn't as active visually as most other works, but this is intentional. The sculpture is a Martin Luther King, Jr. Monument. Too much visual activity seems to detract from the monumental quality.

*Arthur Silverman (New Orleans, Louisiana) is a retired surgeon who has been producing monumental steel sculpture for over twenty years. He was a speaker at AM92 and AM96. His work is based on an intense study of the properties of tetrahedrons.*



Left: Martin Luther King, Jr. Monument, Arthur Silverman, aluminum, 27' x 7' x 3 1/2'. Baton Rouge, LA

Below: Wall piece, Arthur Silverman, aluminum, 19' x 14'. Equitable Center, New Orleans, LA



# Toroidal Closures of Scherk Towers

by Brent Collins

Being a sculptor rather than a mathematician, my work has originated through visual intuition. I was using hyperbolic contours as modular elements of composition years before knowing of their presence in the Scherk and Costa minimal surfaces. In a recent cycle of pieces, the composition of these modules can be understood as a finite vertical Scherk tower of pairwise orthogonal holes that has been rounded into a closed circular shape forming a torus of pairwise orthogonal holes. With an even number of holes these surfaces are orientable and have ends similar to the Costa surfaces (Figures 1 and 2). A toroidal closure of an odd number of holes requires that the tower is also twisted as in the case of a Möbius strip. This results in a non-orientable surface with a single continuous edge that is a knot (Figure 3).

Carlo Séquin has written an elegant computer program that enables one to parameterize these shapes and thereby obtain an infinite number of virtual sculptures. In particular, the program produced virtual sculptures that were beyond my imagination alone. The program can also slice through the geometry to produce blueprints of cross sections, which are then cut from wood and stacked to construct the sculpture. This technique was used for the monkey saddle hexagon in Figure 2 and saved me a lot of time. I am now constructing a heptagon with quadraped saddles that is forbiddingly complex even with the blueprints. Thus by parameterizing my sculpture, the computer program has literally taken me beyond myself.

*Brent Collins (Gower, Missouri) is a sculptor who has presented his work at AM93, AM95, and AM97. His recent collaboration with Carlo Séquin has resulted in new forms that represent the leading edge of sculpture influenced by mathematics.*

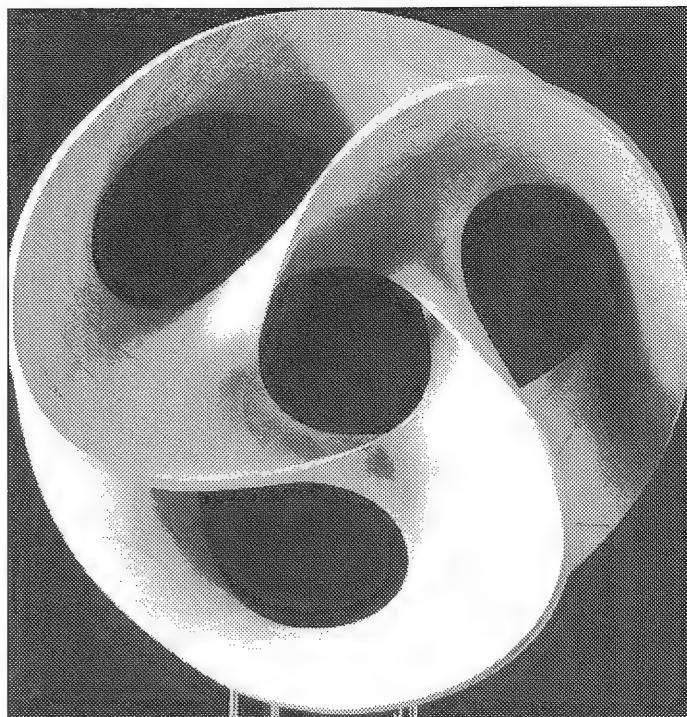


Figure 3. Non-orientable surface with second order saddles.  
(all photos: Phillip Geller)

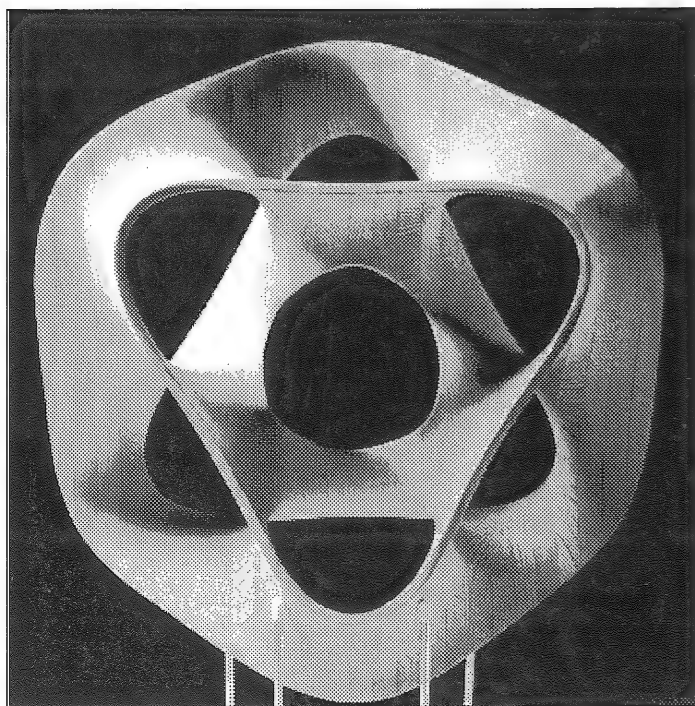


Figure 1. Orientable surface with second order saddles.

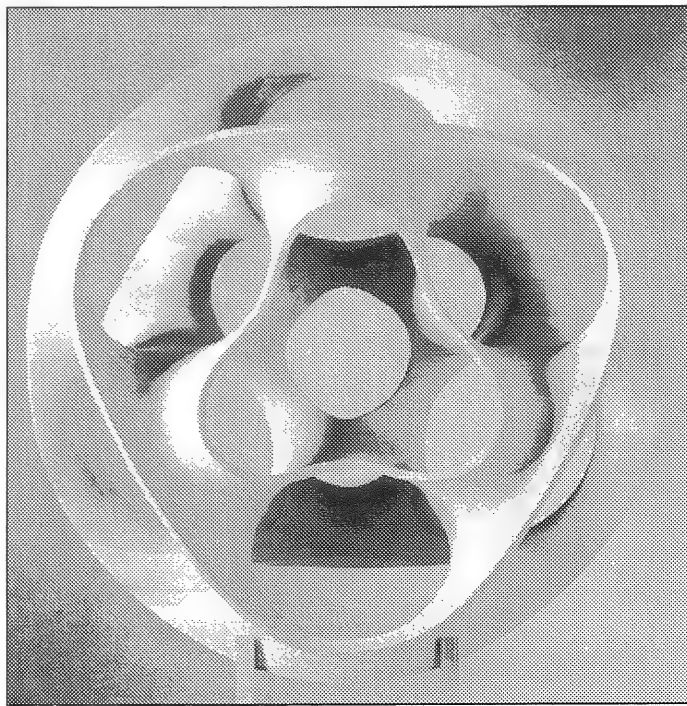


Figure 2. Orientable surface with third order saddles.



# Virtual Prototyping of Mathematically Inspired Sculptures

by Carlo H. Séquin

Abstract topological sculptures of complex shapes undergo a gradual evolution from an idea, through a sketch or mock-up of the concept, to a detailed model searching for the near-optimal implementation of the original idea, to the final refined sculpture. The planning and refinement process may take many weeks and is always labor intensive. In this domain the computer can play an important role as a virtual prototyping tool. If the type of topological sculpture can be defined by a finite number of numerical parameters, then it is feasible to generate a computer program with which one can explore effortlessly many different variations in order to refine and optimize the most promising shapes. This is the case in the topological sculptures of Brent Collins that can be characterized as toroidal closures of finite Scherk towers. A Scherk tower with six stories that has been partially warped 200% into an arch form with a twist is shown in the computer image in Figure 1.

By warping 360%, the two ends will meet to form toroidal closure. The correct twist is required so that the end stories join up properly, as in the sculptures by Collins. The benefit of parameterizing this type of topological sculpture is that one can also generalize the initial Collins sculptures to obtain virtual sculptures of higher degrees of complexity. Furthermore, the program can produce blueprints of cross sections that facilitate constructing an actual sculpture.

There are three other aspects of the program that enhance visualization. One is that the program can produce cross-eye stereo pairs so that one can see the sculptures in three dimensions (see cover). Secondly, the virtual sculpture can be rotated completely in three dimensions so one can see the sculpture from all viewpoints, as in the rotated image in Figure 2. Thirdly, the triangulated surface can be rendered in wireframe mode (Figure 3) resulting in a transparent image in which one can easily follow an edge all the way around the sculpture.

Lastly, a special output file of the program can be sent over the Internet to various fabricators to produce replicas of the described geometry using Stereolithography (SLA) or Selective Laser Sintering (SLS). In this way 3D scale models can be obtained of any of the virtual sculptures. (*This is sculpture heaven. N.F., ed.*)

Carlo Séquin (Berkeley, California) is a sculptor and professor of computer science at UC-Berkeley. He was a speaker at AM97. His recent work was inspired by Brent Collins and this led to the most impressive computer program for generating topological sculpture.

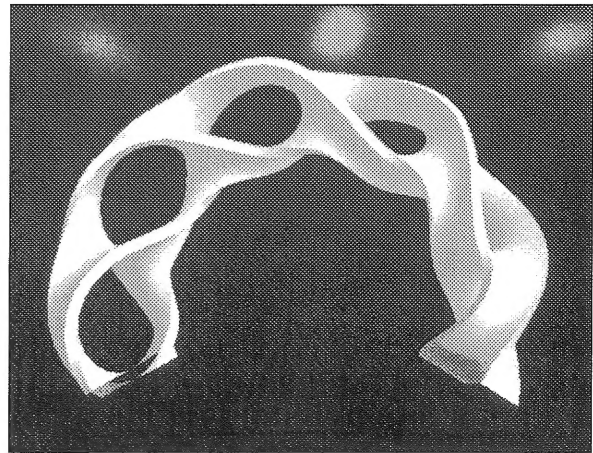


Figure 1.

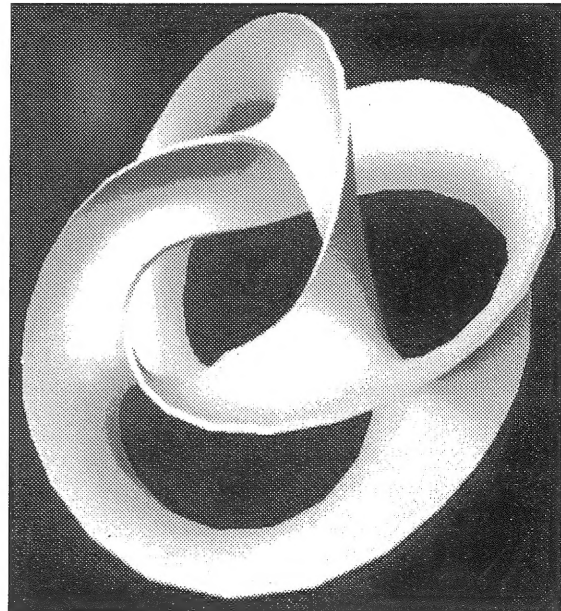


Figure 2.

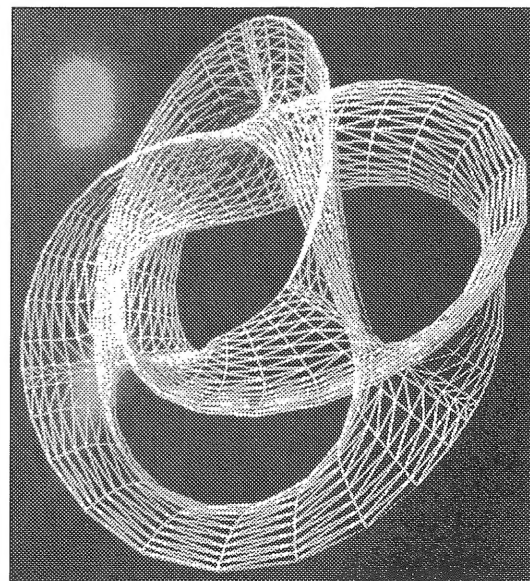


Figure 3.



# A Look at Siggraph '97

by JoAnn Gillerman

We walked for about 15 minutes in the dark, until we heard the buzzing of many people wandering through multiple projections of computer graphics and 60's style light shows. Techno-ambient acoustics loudly filled the night with SM tribal performances. It was a Siggraph rave in the LA Zoo at night! And the only animals not totally closed off to the public (us!) were reptiles—specifically and mostly snakes! How appropriate. (For those of you who don't know me—I am “Viper Optics” and have cohabited with Fafnir, my Colombian boa for

many years!) So this was an opening event of Siggraph 97—in Los Angeles! Now, compare this to the basically academic gatherings of computer graphics gurus during Siggraphs of the 70s. Quite the contrast.

*Siggraph '97 in Los Angeles was overwhelming and exciting—as usual*

I was immediately struck by the size of the conference and how it had grown. Having attended my first

Siggraph in the late 70s, and becoming somewhat of a regular in the early/mid 80s, the last one I had attended was in '93 (Anaheim) when my “New Electronic Media” Class's collaborative project Electro-Healing Interactive Installation was shown in Siggraph 93's “Tomorrow's Realities”.

Realizing that I probably would not be able to see all of Siggraph 97 in the few days, I tried to be somewhat discriminating and target certain areas of interest.

On the way down to the Electric Garden, we encountered a hovering telerobotic airborne “blimp” embedded with small camera and speakers, which was wandering aimlessly around the spaces transmitting into their base station of the Electric Garden. I spent significant time in the Electric Garden, a large area of primarily interactive works with several installations, creative interfaces, original displays, virtual worlds and environments worth noting.

One work that made a significant impression on me was Virtual Basketball. Now, I'm not usually one for basketball, and passed up this somewhat subtle installation the first time, dismissing it as just another virtual sports game—not my interest. But on recommendations and observing the constant line of participants, I decided to give it a try. First, you have to free yourself of any hanging off the shoulder heavy bags of often-not-looked-at-again-collected-trade-show-stuff and step into the “virtual court” space. Four velcro rings—attached to delicate, almost invisible taut wires—are strapped to your index and ring fingers; you are now subtly wired and instructed to grab the ball. I wasn't expecting what happened next. There is a certain way to hold this ball—and when you grab it correctly, you actually feel the volume, weight and gravity of a basketball (dynamic force feedback). Totally Cool!

Obviously, you can't throw it until you are holding it (and feeling it). And your personal trainer tells you to keep your hands at the constant distance to hang onto the ball while you slowly bring the ball up toward your chest, then throw it toward the basket—and, by the way, don't forget to let go of the ball. It is important to let go of the ball after you throw it if you want to sink it. (In real life, I have never been good at knowing when to release a ball, and consequently have wildly and unexpectedly thrown backwards, sideways or wherever.) Same principals apply here, too. You do not necessarily score if you let the ball go too soon or too late. And also, of course, if you let go of the ball it bounces, you've lost it until another ball appears in its place to try again. It was so very tactile—a beautiful interface.

Another, very subtle yet very elegant work combined the electronics on a hat visor which you wear as you hold a small cube of screens—a flat LCD screen on each of the six faces of the cube. You select the image you want to virtually view and then, as you move your head, look from different perspectives on the corresponding cube faces. A large 3-D panoramic view of the Mars landscape taken by the Mars Pathfinder rover was a distinguishing feature of JPL's display. The Air Force displayed a 270-degree panoramic series of images with flight simulators to give you a real view of flying a plane through a real landscape, a system which will be implemented for real sometime this year. (I only saw military uniformed Air Force guys playing this one!) And a projected virtual 3-D world lets you fly through blood vessels of a body looking for T2 bacteriophages affecting immune system disorders in the blood.

The Film/Video show was consistently good this year—at least for my tastes. It was heavy on science, space, and medical, with several shorts sporting a weird, twisted and often peculiar sense of humor. (I would say that the imagery was on a whole more blobby than I have seen in years!) I particularly enjoyed an explanation of how DNA replicates in highly visual informational form. A highly stylized computer graphics animation of an Amazonian Tribal Story provided a refreshing contrast from the usual. An impressive fly-around virtual tour of UCB campus was created from just 20 stills. There was even one PC piece that made a rather grotesque statement about eating meat. And, as usual, an excellent and dense glimpse of many of the current Hollywood special effects in current theatrical releases.

All this is to say that Siggraph 97 in LA was overwhelming and exciting as usual.

JoAnn Gillerman is an artist and associate professor of electronic media—computer, video, sound—specializing in interactive technologies. Her website is located at <[www.vipervortex.com](http://www.vipervortex.com)>.



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is an international

n., pronounced eye-lum,

1. a Greek word for the

exploding mass from which

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## Ylem

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